

# TISA Status

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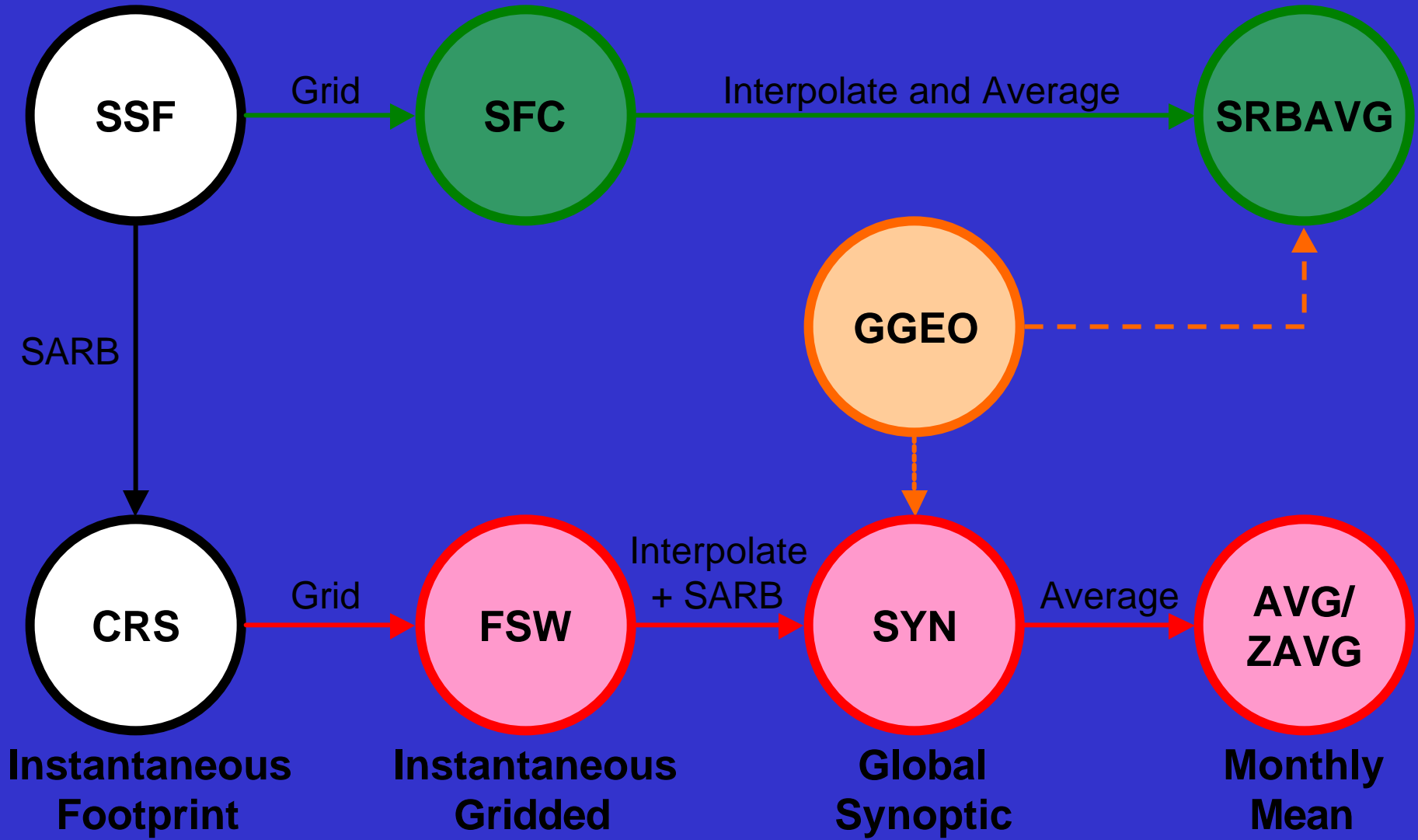


# Outline

- Data products update
- Improvements to GGEO for Terra
- First look at a year of global SRBAVG data



# CERES Advanced TISA Processing



# **TISA Software Development Status**

## **FSW / SYN / AVG / ZAVG**

- Software updated to include overlap hours
- Cloudy sky/No Aerosol Flux profile data added
- TRMM ADM types used to sort Terra FSW SW flux
- The HDF compression was added to AVG/SYN to reduce the output file size. A savings of approximately 70%
- 3-hourly integration algorithms implemented



# SYN Movie 10 Days of Hourly Synoptic Data

## Total-sky TOA Longwave Flux From CERES Process

TRMM\_PFM July 1998 TSI

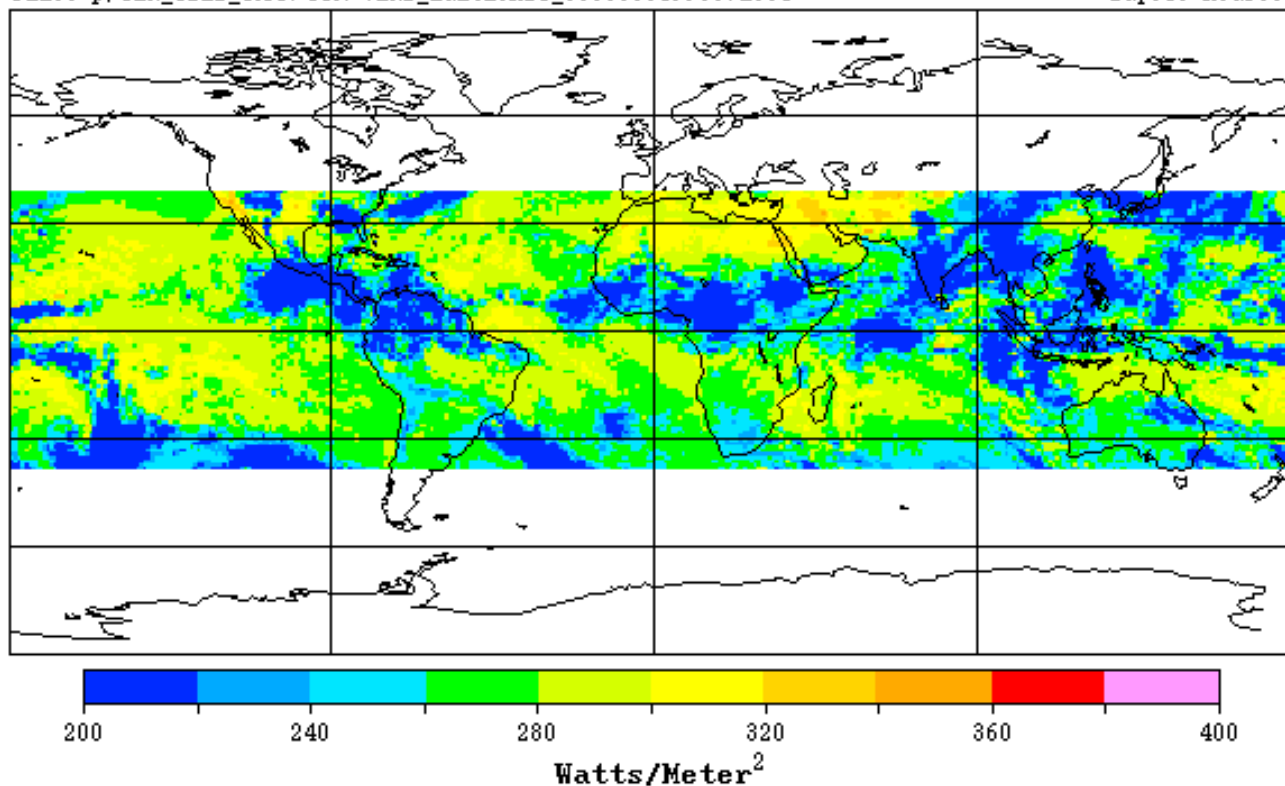
Processed: 2003/11/13

1-deg Equal Angle Nested

Hourly Interpolated Data

File: p/CER\_TSIB\_TRMM-PFM-VIRS\_Edition2C\_000000.1998072001

Day:10 Hour:00



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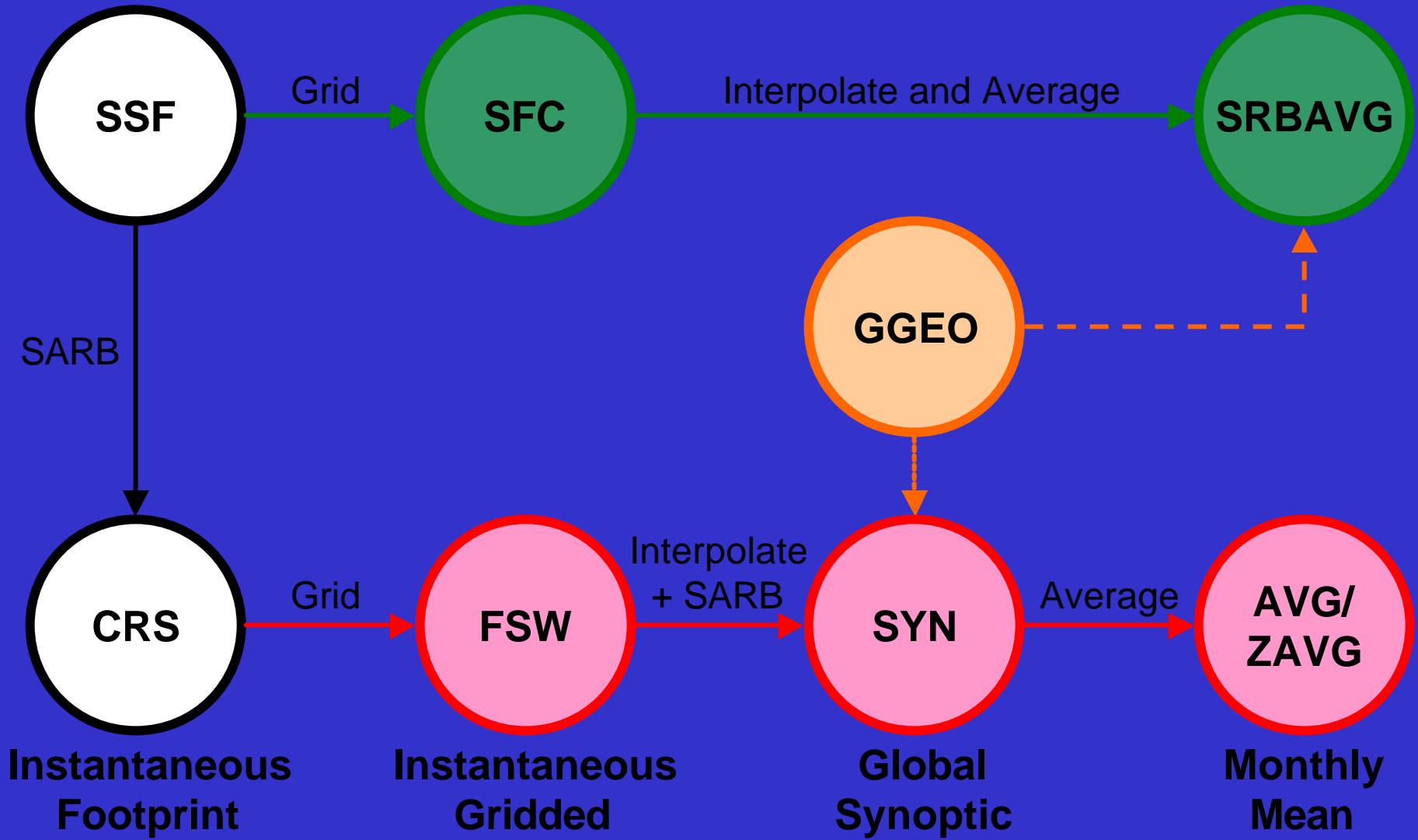
# What's Next?

## FSW / SYN / AVG / ZAVG

- Product on hold - emphasis on SRBAVG
- Run on Terra data
- Run latest version through SARB
- Produce AVG and compare with SRBAVG monthly means



# CERES Advanced TISA Processing



# TISA Software Development Status

## GGEO

- Calibration time series finalized
  - VIS from deep convective clouds
  - IR from ray-matched data (day/night effects removed)
- The GMS navigation errors corrected
- GEO-specific clear-sky albedo thresholds added
- Surface emissivity used for land IR thresholds (set for DAO)
- Hourly calibration tables added (Meteosat)
- Visible and IR histogram information produced for QC
- Cold Cloud and Noon Data collected for calibration QC
- QC Web pages modified
  - Improved interface
  - Improved
- GGEO subsystem updated for consistency with Clouds subsystem





# TISA Data Product Status

## GGEO

- Over 2 Years tested at DAAC
  - Tests stability for operational processing
  - Provides data for calibration time series
- 2001 completed and used in Beta 2 SRBAVG
  - Calibration automated
- Cloud amounts compared with 1998 results



# GGEO Calibration Techniques

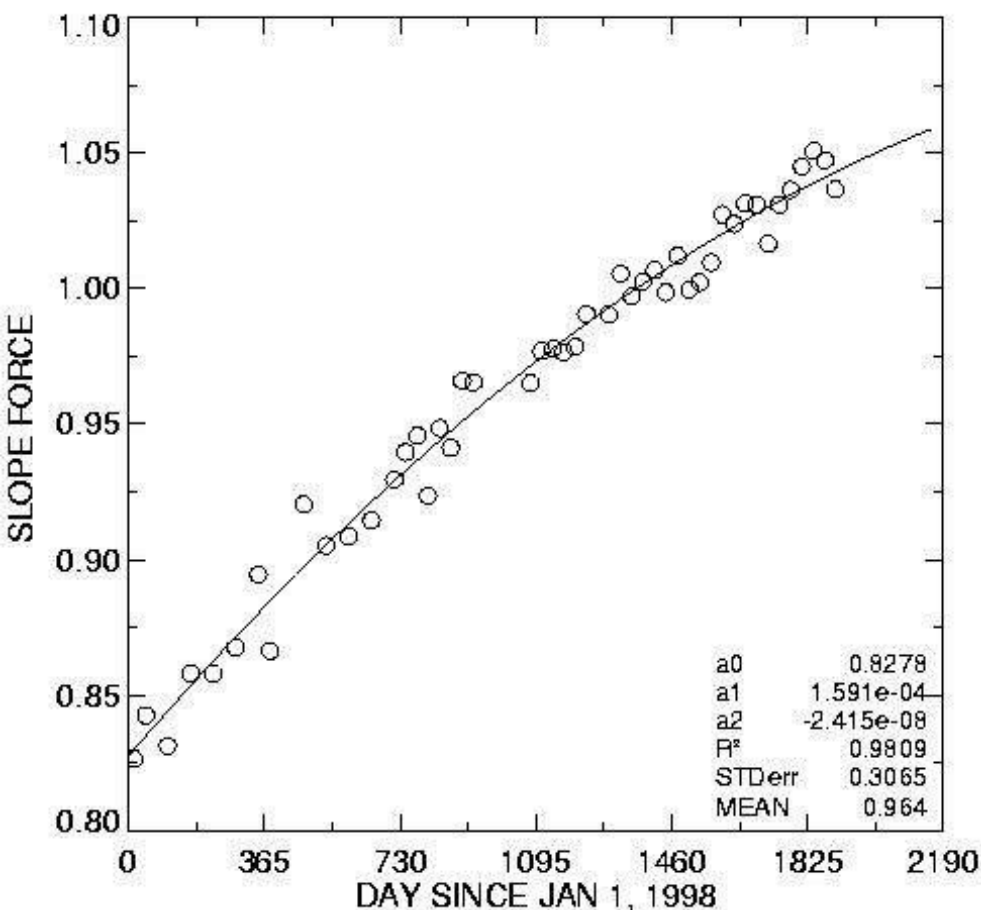
- Ray-matched MODIS vs GEO radiance data
  - Ties calibration to well-calibrated MODIS data
- Deep convective cloud albedo
  - Used to get trends (not absolute calibration)
- Noon matching of GEO data at central longitudes
- Doelling to present results in Co-I report



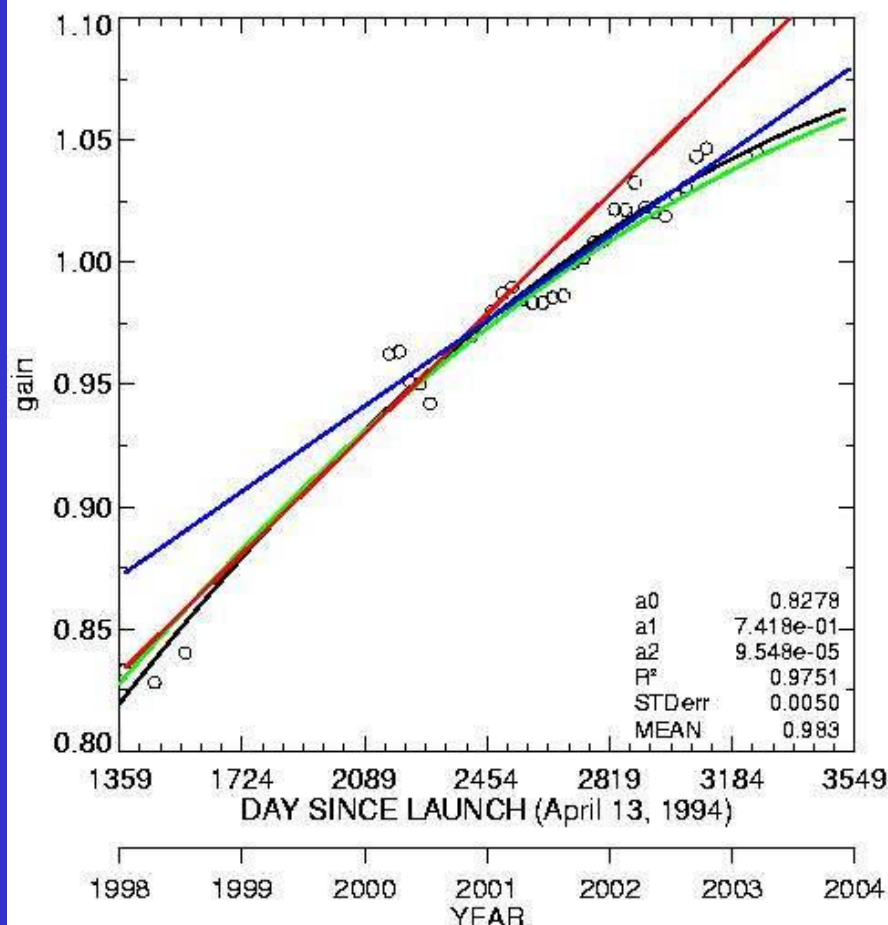
# Consistency of Calibration Methods

GOES-8 vs VIRS, 1998-2003

visible, 0.65 $\mu$ m



COLD CLOUD GAIN for GOES-8



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# GEO Clear-sky Threshold Correction Objective

- MODIS clear-sky albedos are used in GEO cloud retrievals
  - Results in overestimate of daytime cloudiness over land
- Spectral differences result in differences in
  - Surface reflectivity
  - Atmospheric absorption
  - Rayleigh scattering
- Need to derive correction factors as a function of
  - GEO satellite
  - Surface vegetation type
  - Season

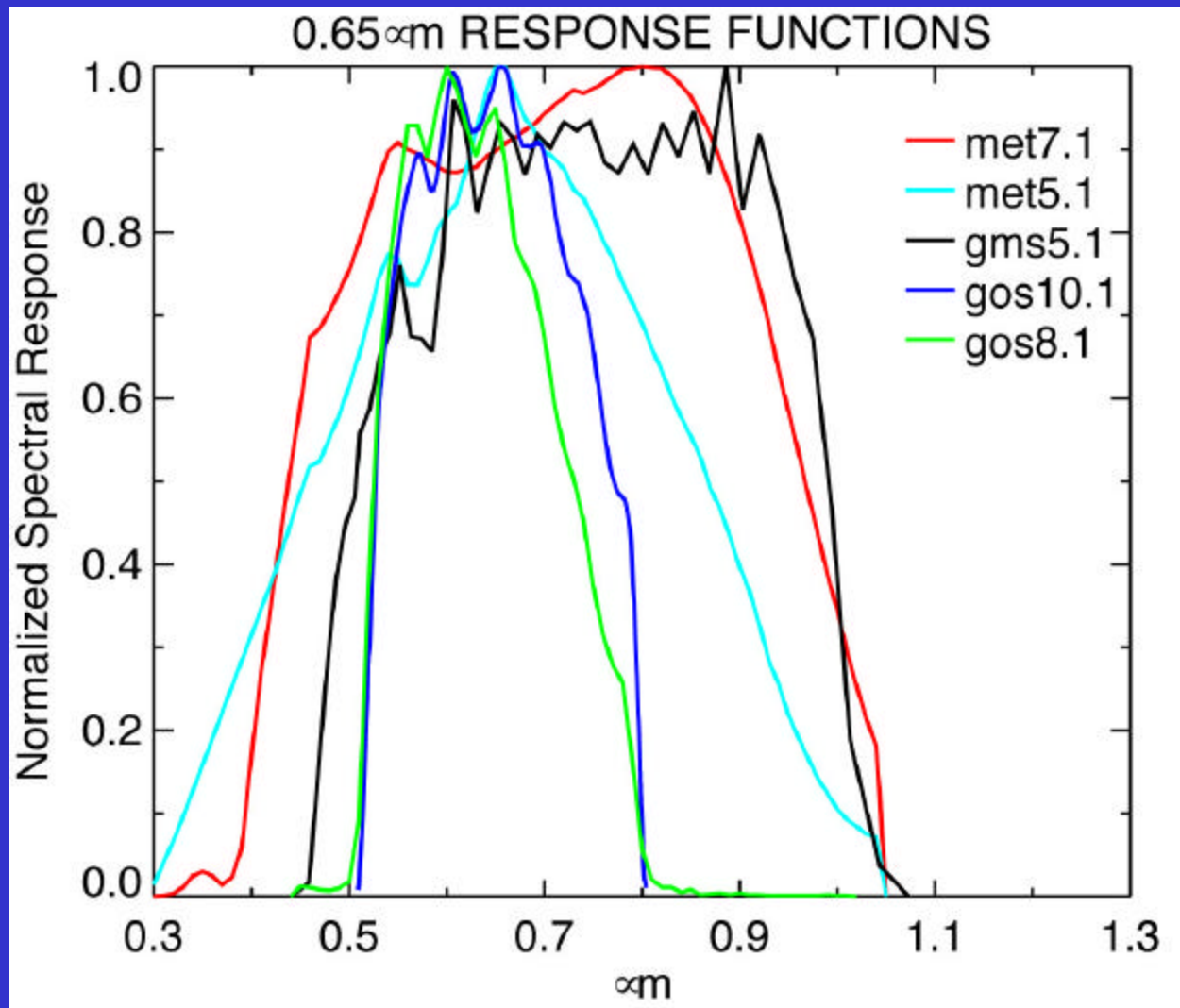


# Method

- Use MODIS monthly start-up maps
  - Average from 10-minute to 1° resolution
- Compare with GEO data from January and June 2001
- GEO albedos derived using
  - Minimum values
  - A variety of directional models
- Derive GEO/MODIS albedo ratios after eliminating
  - Snow regions
  - High GEO standard deviations
- Average for each scene type & GEO satellite



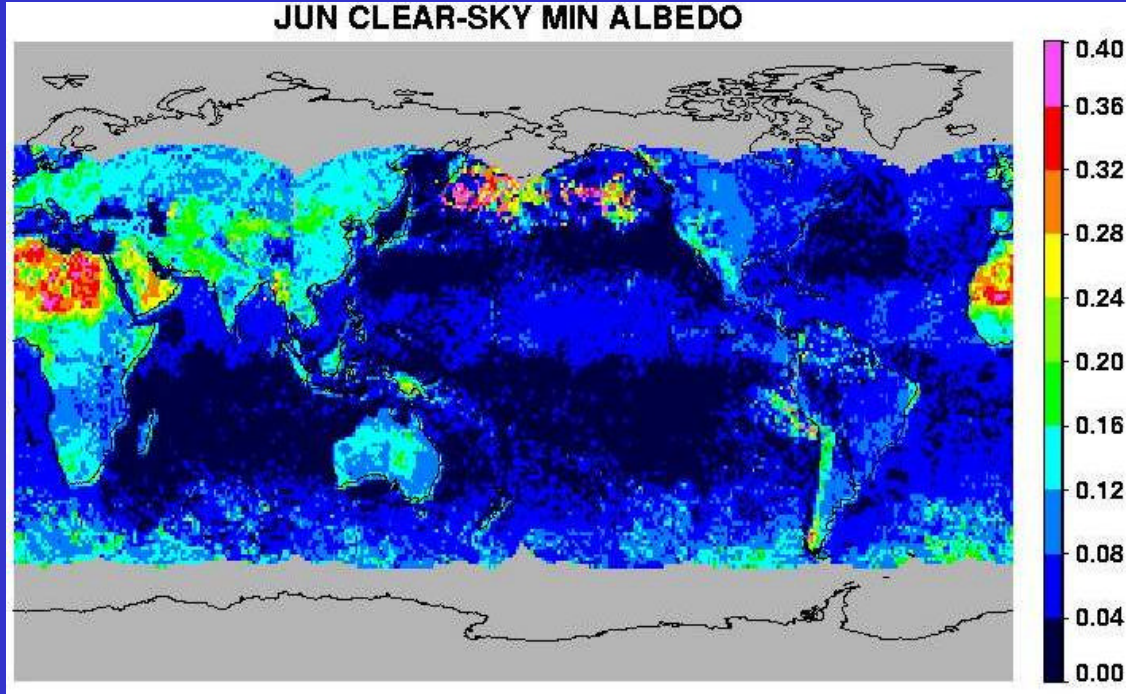
# GEO spectral response functions



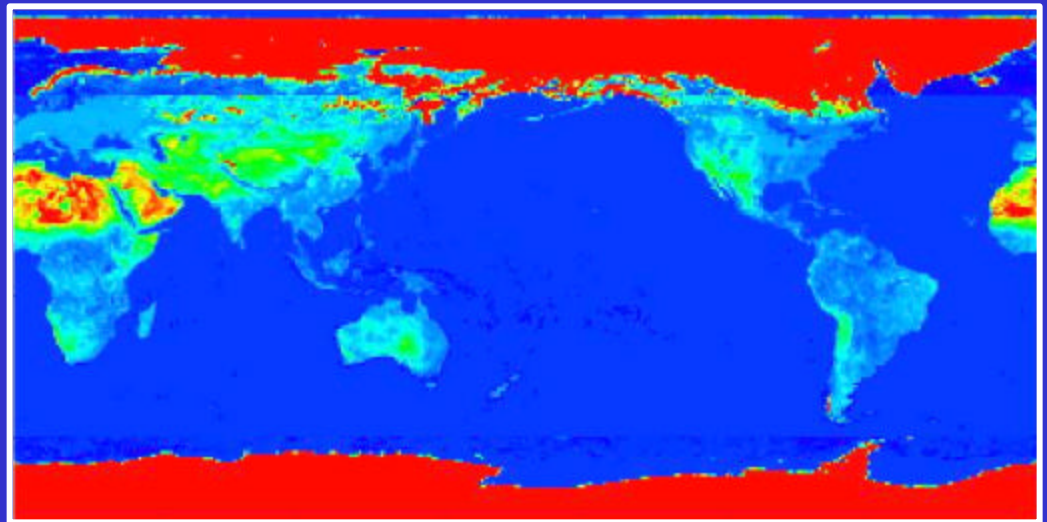
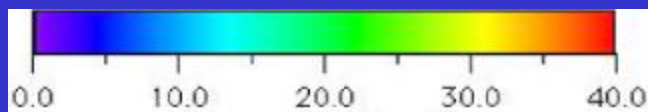


June 2001

GEO Clear-Sky Albedo



MODIS Clear-Sky Albedo



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## Results for January 2001

	METEOSAT-7 Ocean	METEOSAT-7 Land	METEOSAT-7 Desert
Correction:	0.85	1.15	1.25
VIRS cloud fraction	0.66	0.54	0.06
GEO cloud fraction (uncorrected)	0.66	0.74	0.18
GEO cloud fraction (corrected)	0.68	0.62	0.10



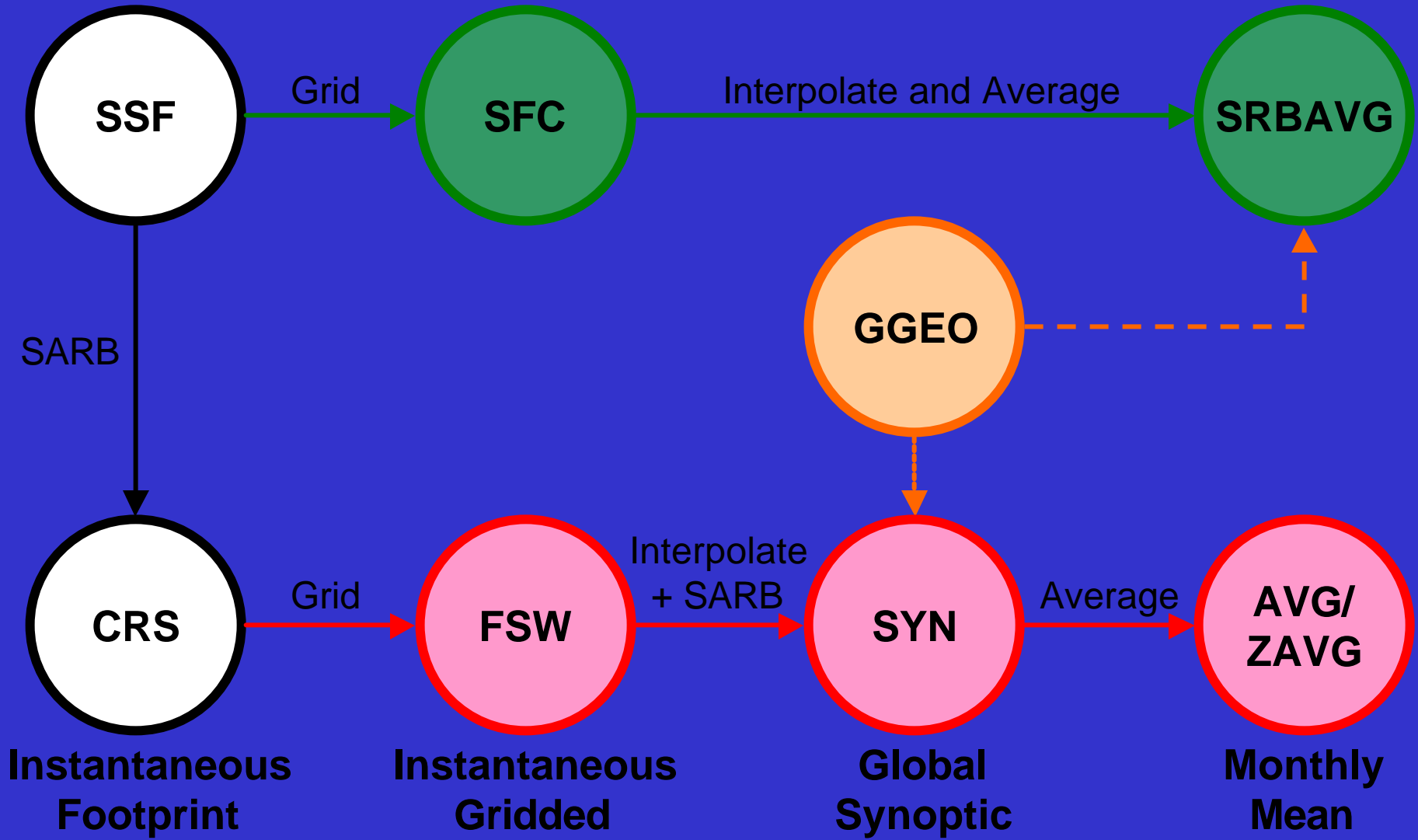


# GGEO Status Summary

- Calibration finalized
- Clear-sky threshold to be finalized this week
- Delivery soon



# CERES Advanced TISA Processing



# TISA Software Development Status

## SFC / SRBAVG

- 1 year of Beta 2 in archive
  - GGEO cal not final
  - old NB-BB
  - Edition 1 fluxes & clouds
- TRMM directional models used for Terra
  - TRMM ADM types were written onto Terra SFC FSW products
- The HDF compression was added (Saves ~70%)
- Final development:
  - New NB-BB
  - Nighttime interpolation



# TOA Net Flux from Terra FM-1 2001

## Total-sky TOA Net Flux From CERES Process

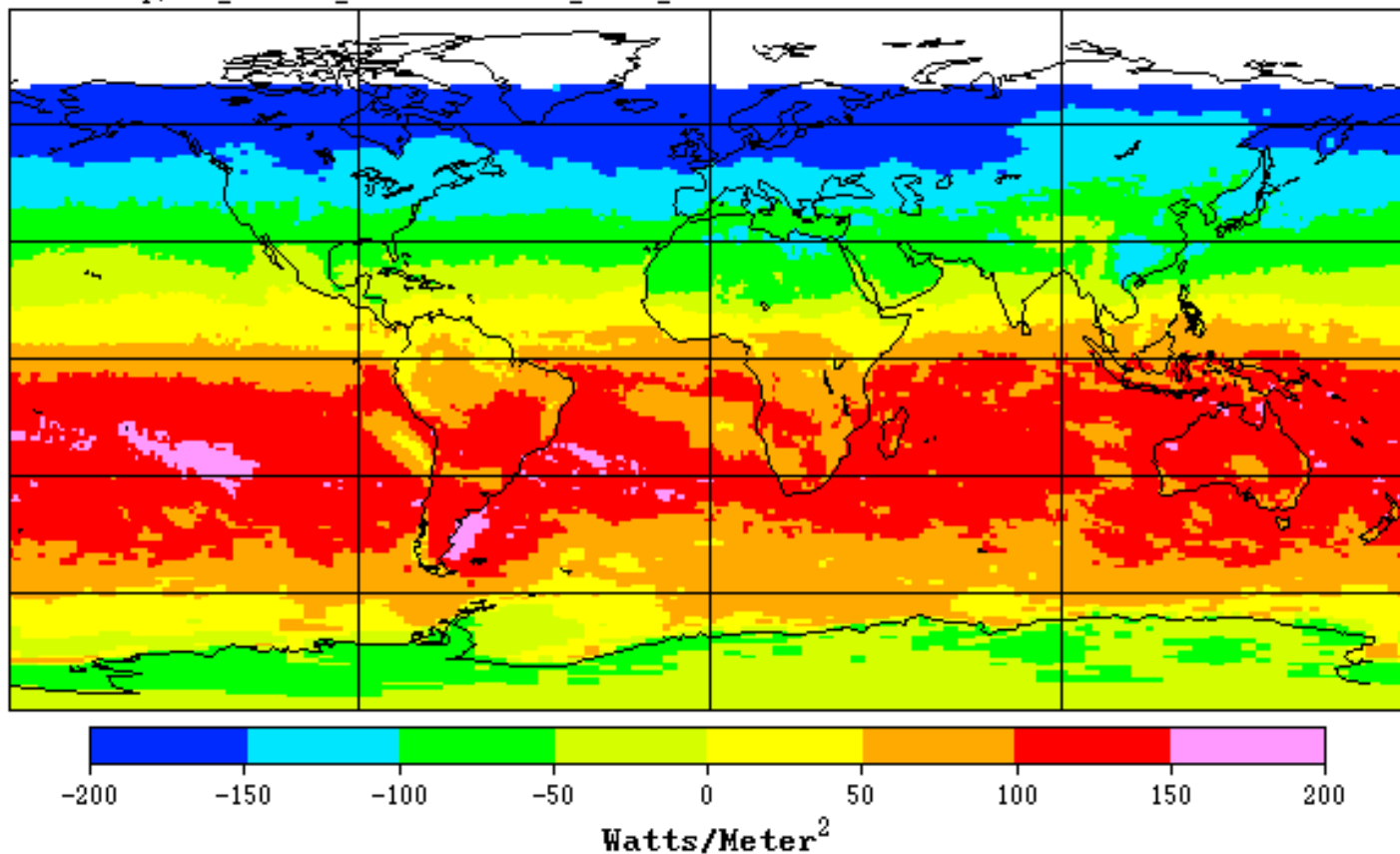
TERRA\_FM1 January 2001 SRBAVG

Processed: 2003/05/21

1-deg Equal Angle Nested

Monthly Mean (Method A)

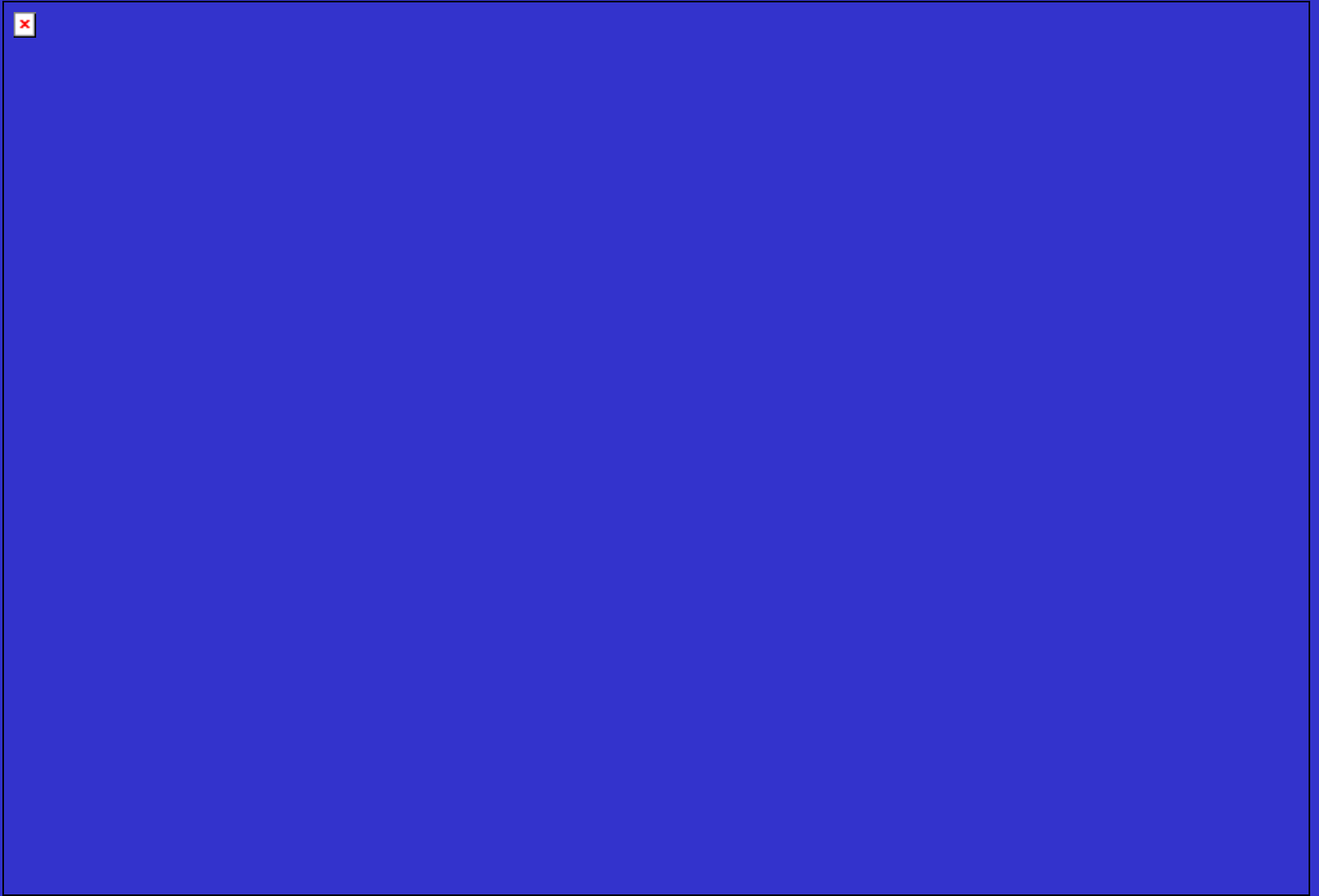
File: comp/CER\_SRBAVG1\_Terra-FM1-MODIS\_Beta2\_011020.200101



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# ERBELike - SRBAVG Seasonal Net TOA Flux



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# Global Annual (2001) Mean TOA All-sky Fluxes

	ERBELike	nonGEO	GEO
LW	238.7	238.2	237.5
SW	98.0	98.1	98.6
Net	4.6	6.5	5.0
Albedo	28.7%	28.7%	28.9%

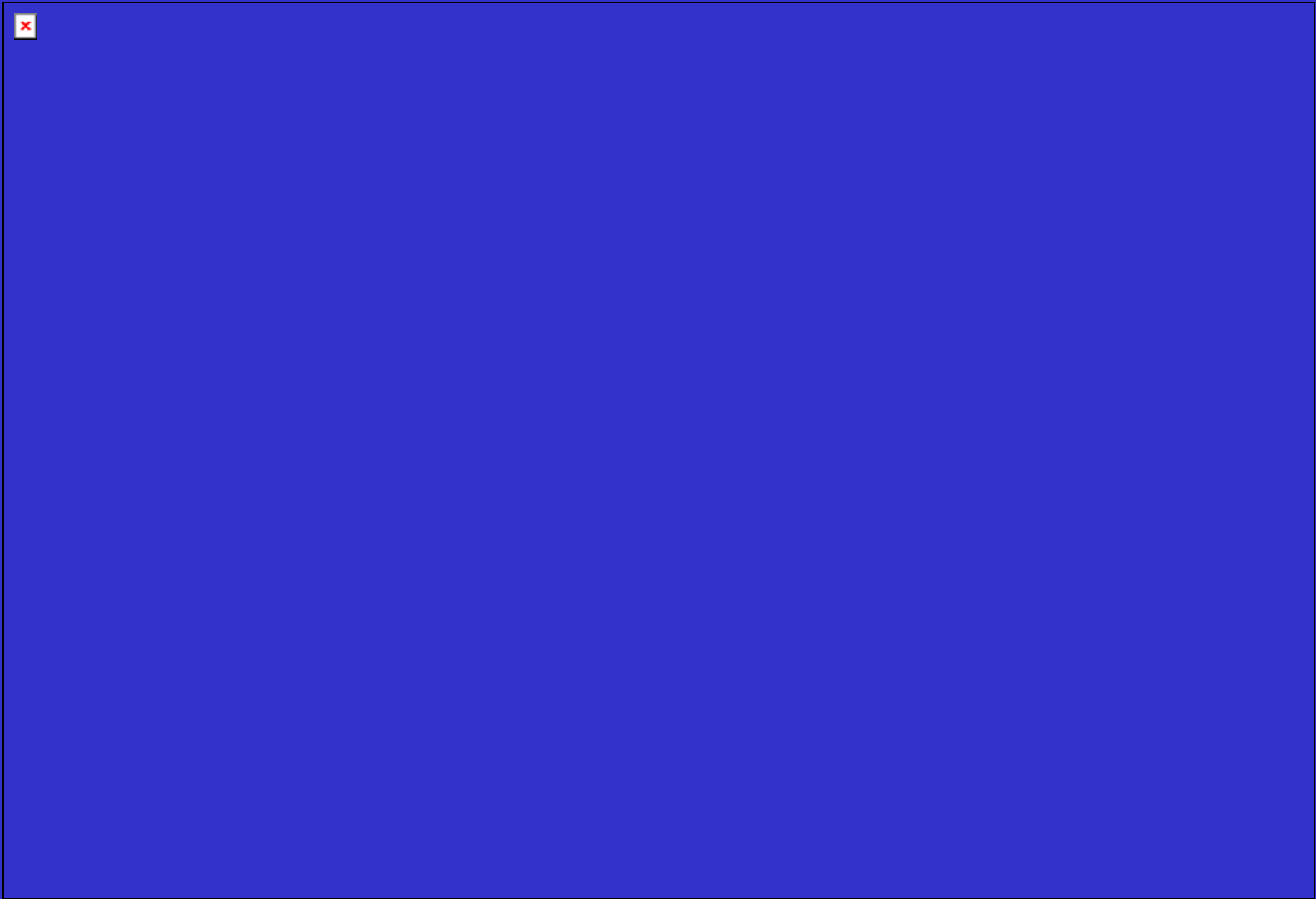


# Interannual Variation of Global Mean TOA All-sky Fluxes

	3/00 - 2/01	3/01 - 2/02	3/02 - 2/03
LW	238.6	238.7	239.3
SW	98.7	98.0	97.1
Net	4.0	4.7	4.9
Albedo	28.9%	28.7%	28.4%



# ERBELike - SRBAVG Annual Net TOA Flux



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# ERBELike - SRBAVG Annual SW TOA Flux



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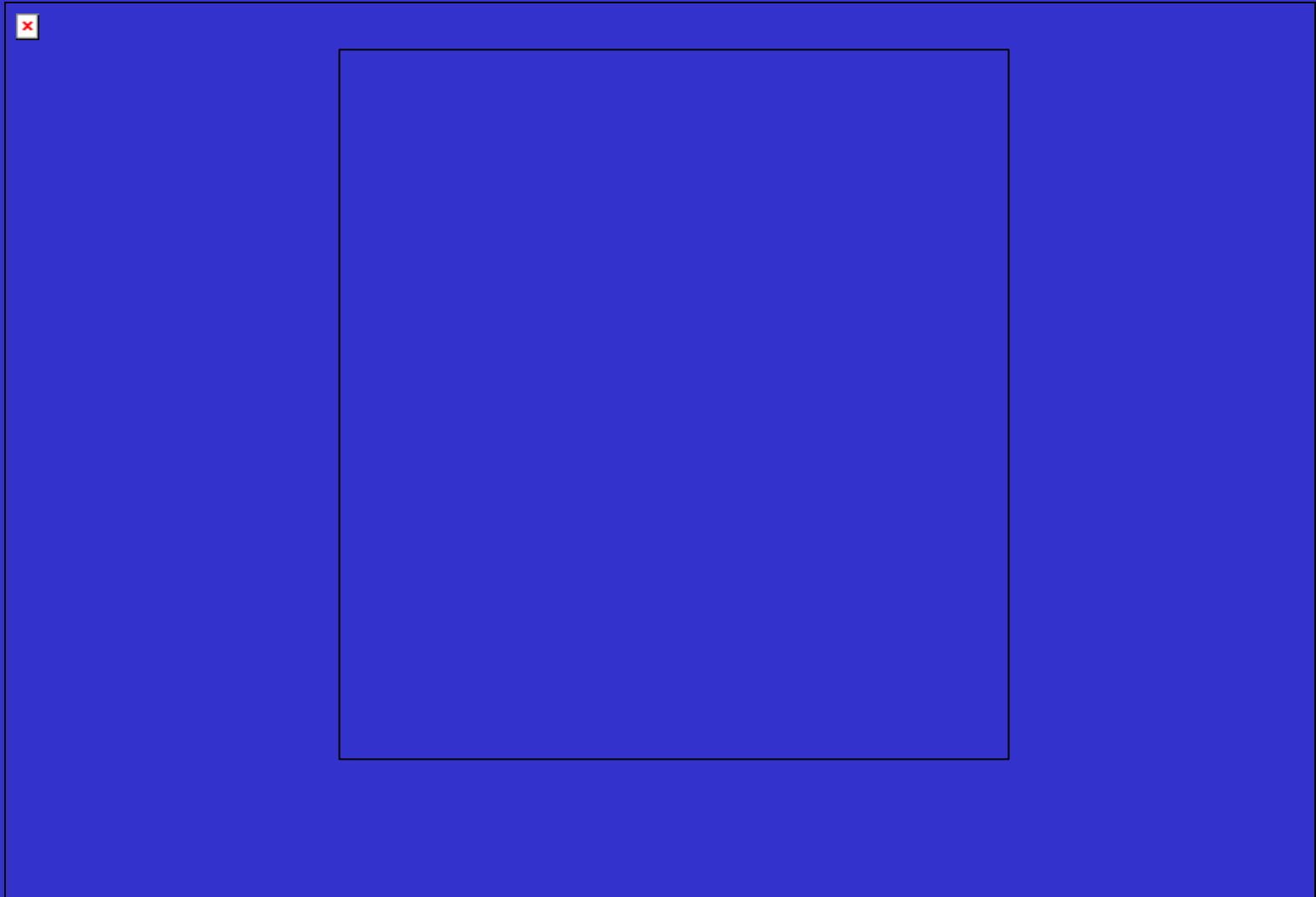
# ERBELike - SRBAVG Annual LW TOA Flux



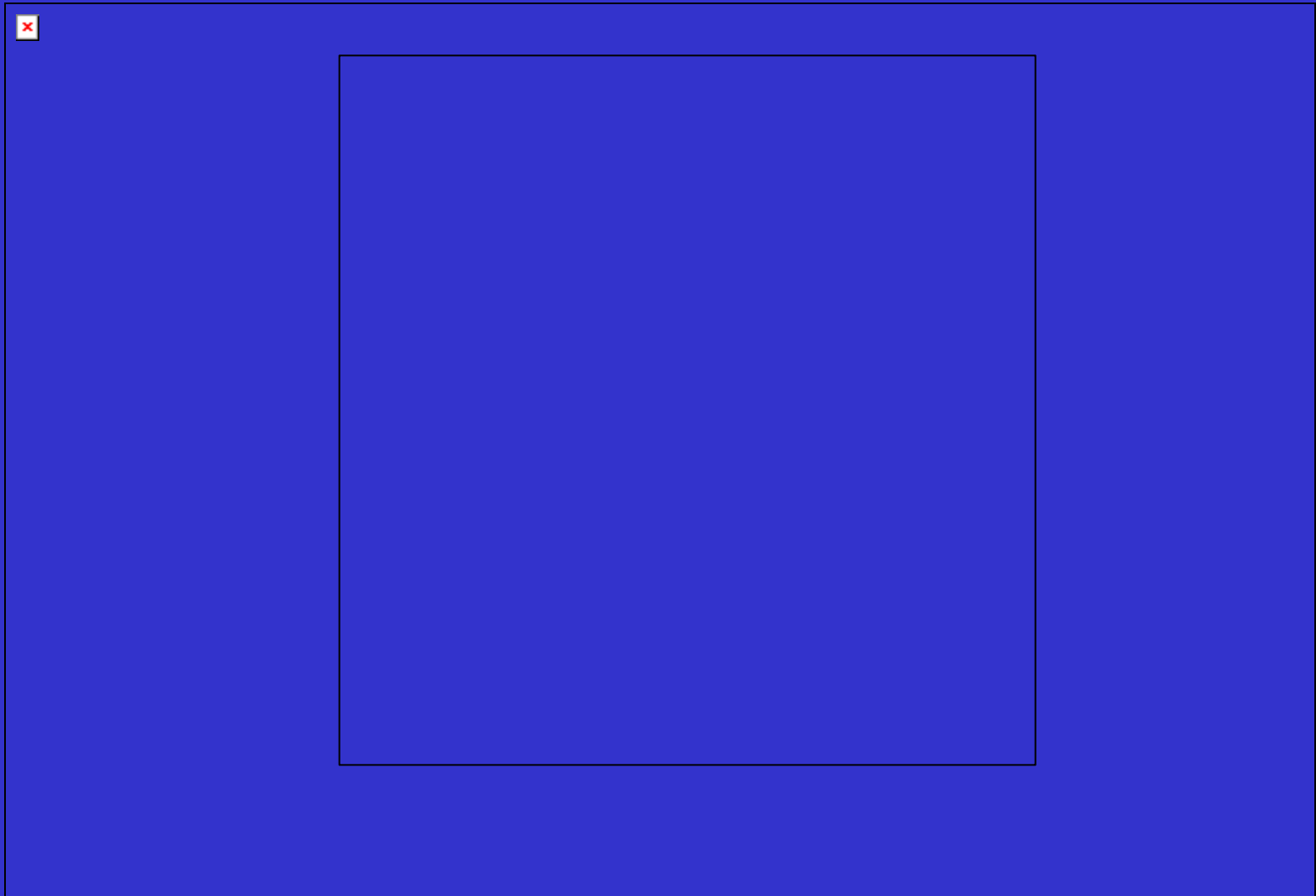
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# ERBELike - SRBAVG Annual Night LW TOA Flux

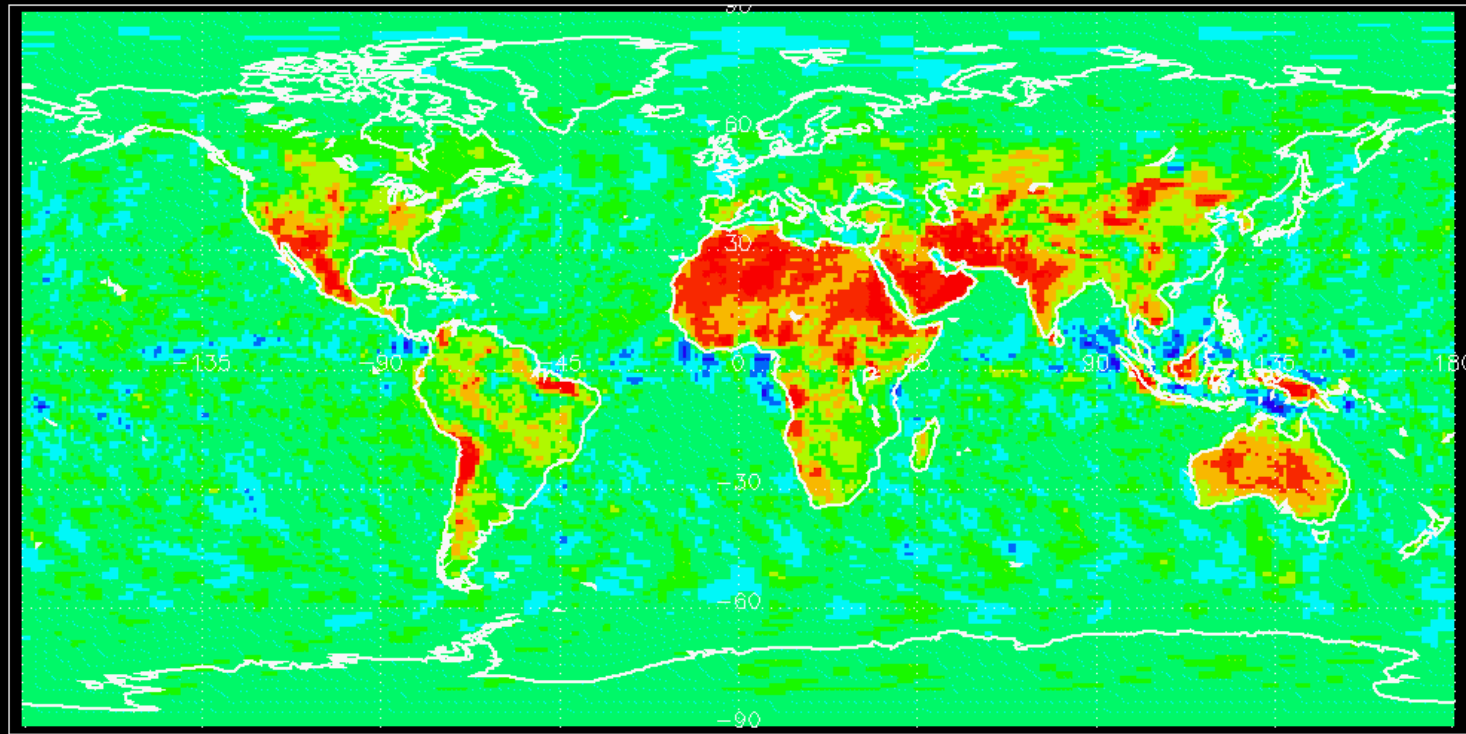


# ERBELike - SRBAVG Annual Day LW TOA Flux



# LW Diurnal Range (Noon - Midnight) GEO April 2001

larc.nasa.gov/DaveY/Terra\_FM1\_200101\_wt\_new\_GGEO/CER\_SRBAVG1\_Terra-FM1-MODIS\_Beta1\_011019.200104 Sun Nov



No -50 -38 -27 -16 -5 5 16 27 38 50 -->  
(1) Data & (2) Std Dev: Watts per square meter, (3) Num. Obs.: Unitless

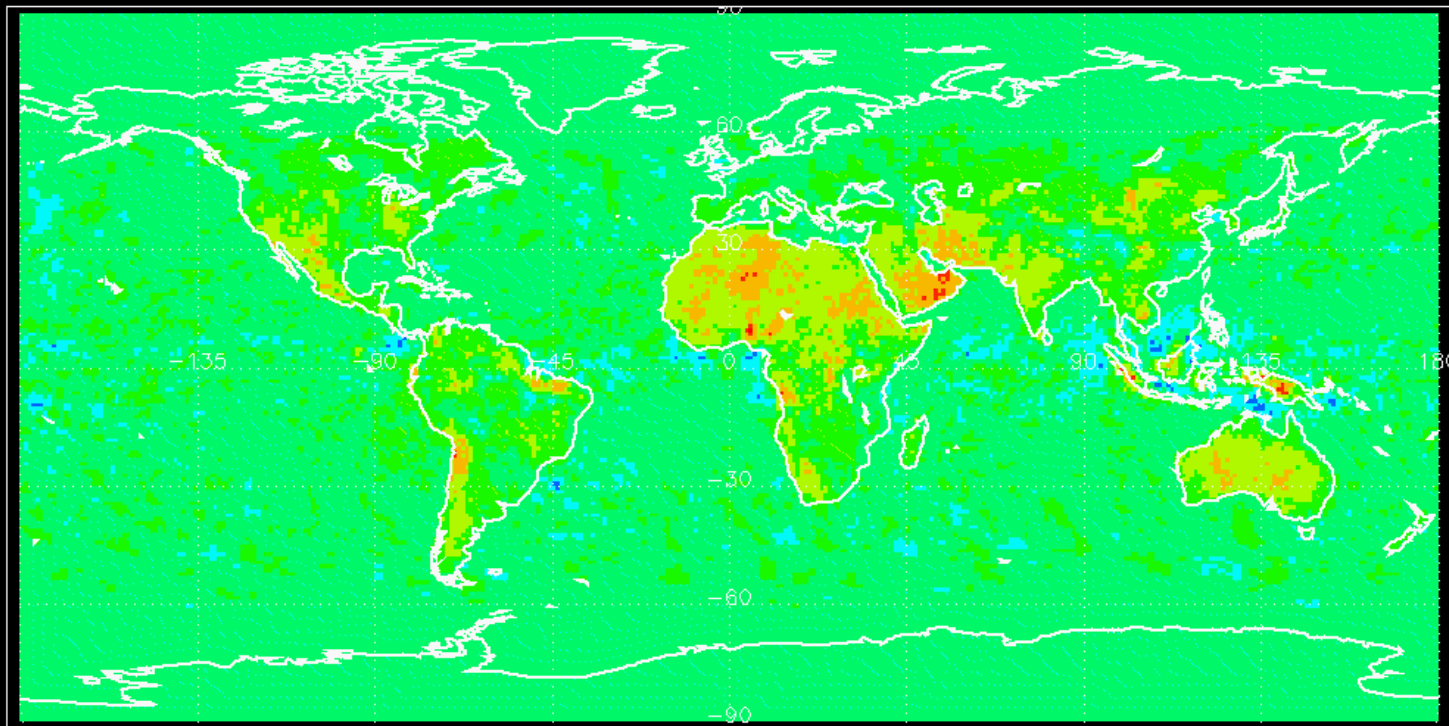


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# Monthly Mean GEO-nonGEO Total-sky LW Flux Diurnal Range April 2001

larc.nasa.gov/DaveY/Terra\_FM1\_200101\_wt\_new\_GGEO/CER\_SRBAVG1\_Terra-FM1-MODIS\_Beta1\_011019.200104 Sun Nov



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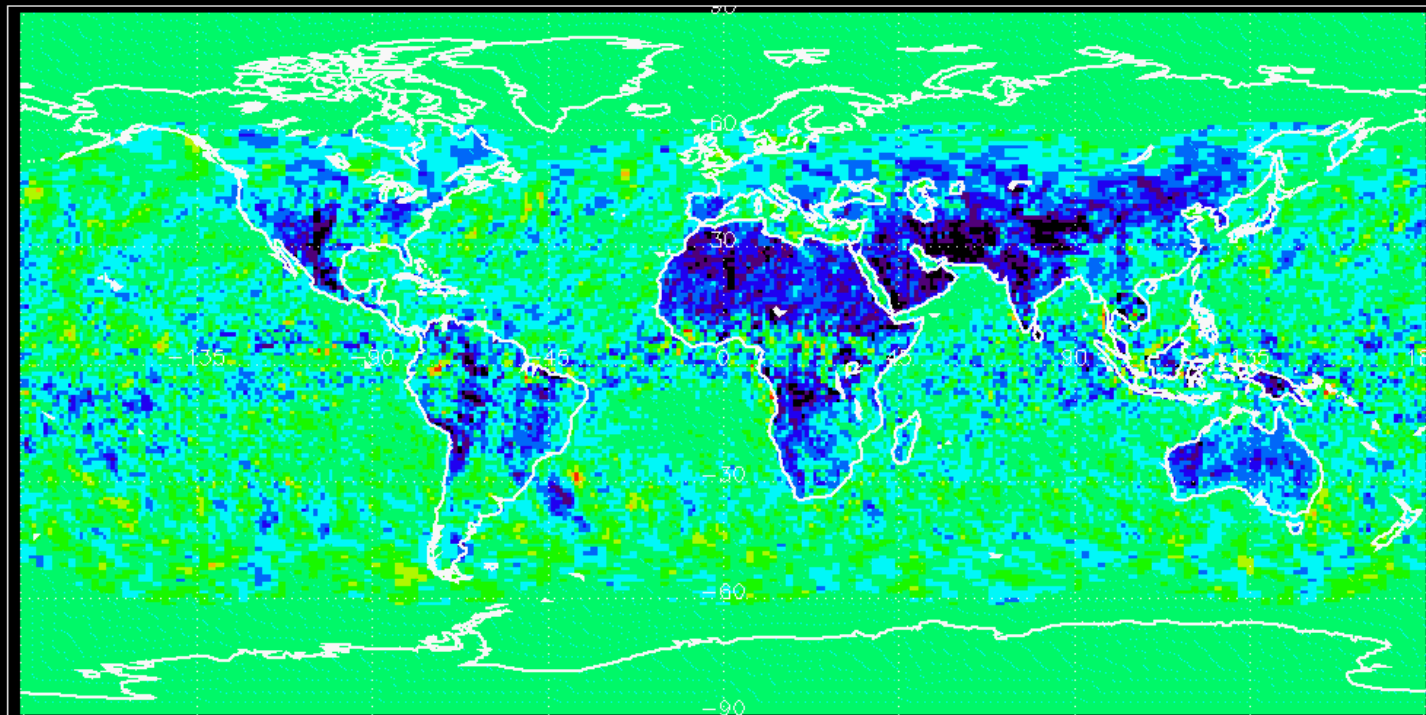


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# GEO - nonGEO TOA LW Flux Difference Monthly Mean April 2001

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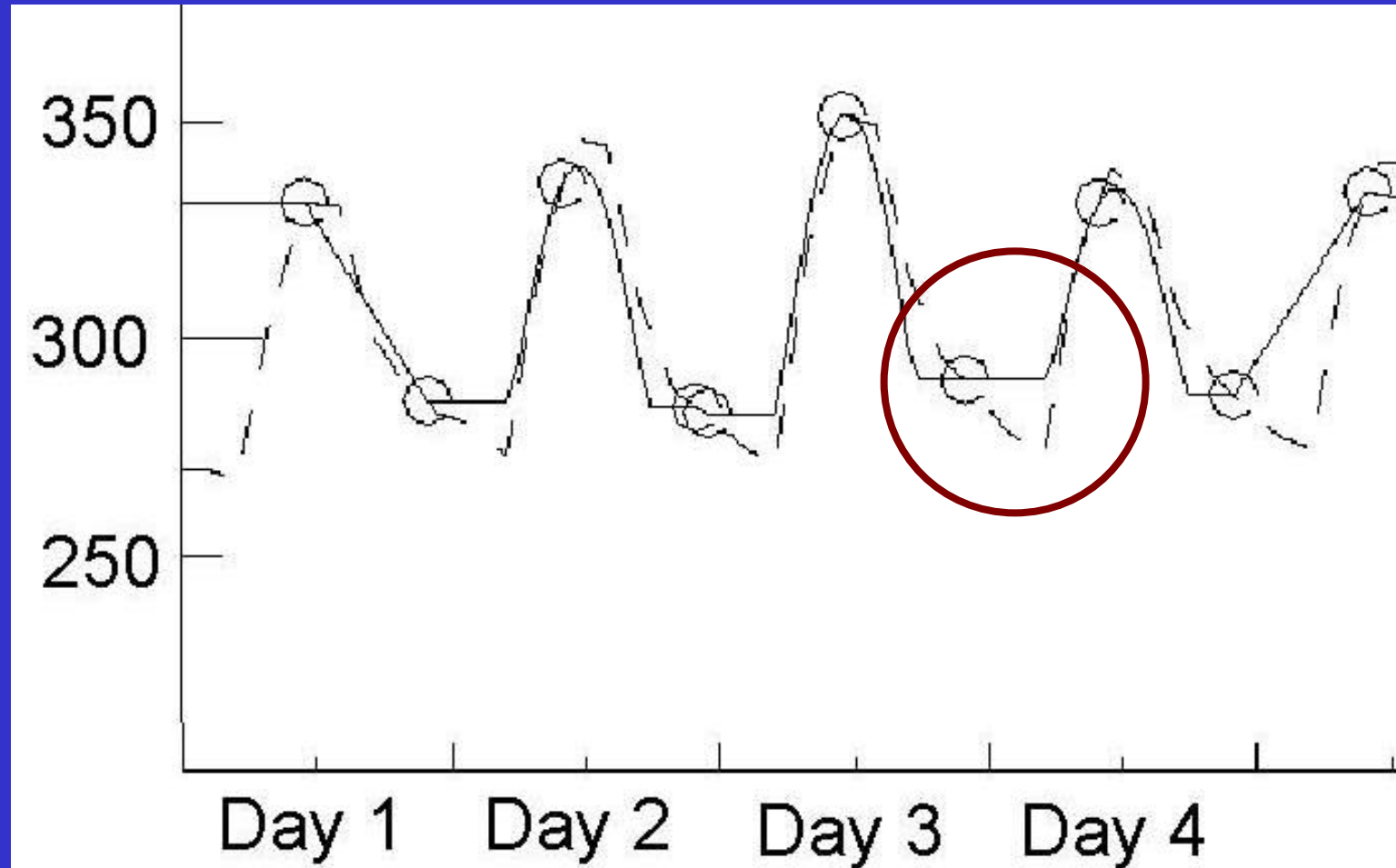
No -10 -7 -5 -3 -1 1 3 5 7 10 -->  
(1) Data & (2) Std Dev: Watts per square meter, (3) Num. Obs.: Unitless



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## Total-sky LW Flux (Sahara April 2001)





# Global TOA LW Flux Comparison

## Beta 2 SRBAVG     January-December 2001



238.7 W/m<sup>2</sup>

237.5 W/m<sup>2</sup>

238.2 W/m<sup>2</sup>



# Global TOA SW Flux Comparison

## Beta 2 SRBAVG January-December 2001



98.0 W/m<sup>2</sup>

98.6 W/m<sup>2</sup>

98.1 W/m<sup>2</sup>



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# Global TOA Net Flux Comparison

## Beta 2 SRBAVG January-December 2001



4.6 W/m<sup>2</sup>

5.0 W/m<sup>2</sup>

6.5 W/m<sup>2</sup>



# Summary of First Look at Annual Mean

- Global net 5 W/m<sup>2</sup> imbalance occurs in both ERBElike and SRBAVG products
- Error Budget
  - Ocean Heat Storage      0.5 - 1.0 W/m<sup>2</sup>
  - SW ADM errors      0.5 W/m<sup>2</sup>
  - LW ADM errors      0.1 W/m<sup>2</sup>
  - SW TISA error      0.6 W/m<sup>2</sup>
  - LW TISA error      0.1 W/m<sup>2</sup>
  - Solar Constant error      0.9 W/m<sup>2</sup>
  - CERES cal error      0.5 W/m<sup>2</sup>
- If all in same direction, possible total of 5.4 W/m<sup>2</sup>



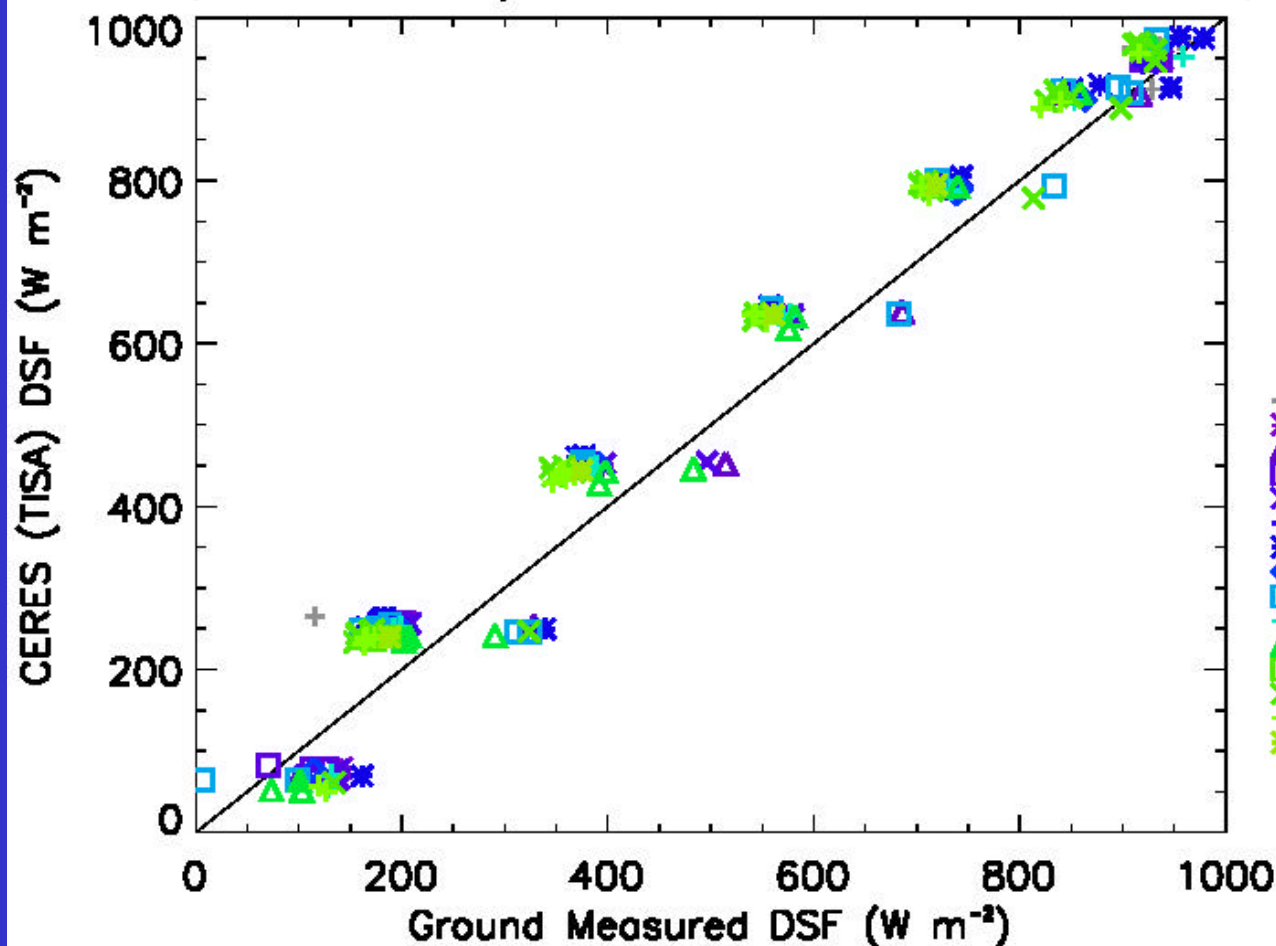
# Validation

- Solved time matching problem for surface comparisons
  - Improves clear-sky surface SW rms
- Initial Terra surface comparison with BSRN
  - Calibration in Beta SRBAVG causes overprediction of cloudiness.
  - Top priority after final calibration
- New cloud property validation set



# SRBAVG DCSW vs. ARM SGP (uncorrected)

Comparison of Downward Shortwave Flux(30min-July)  
(Surface-only; Shortwave Model A – Clear )



Statistics:

Npoints = 164

Mean X = 486.2

Mean Y = 522.1

Mean Bias = 35.9

RMS Diff. = 63.4

Sites:

NPoints:

+	LARNED	5
*	HILLSBORO	5
*	PLEVNA	5
△	HALSTEAD	10
x	TOWANDA	11
+	ELK FALLS	11
*	COLDWATER	16
◇	ASHTON	16
□	BYRON	18
+	LAMONT	14
△	MORRIS	15
◇	MEEKER	22
x	CORDELL	29
+	CYRIL	21
*	SEMINOLE	4

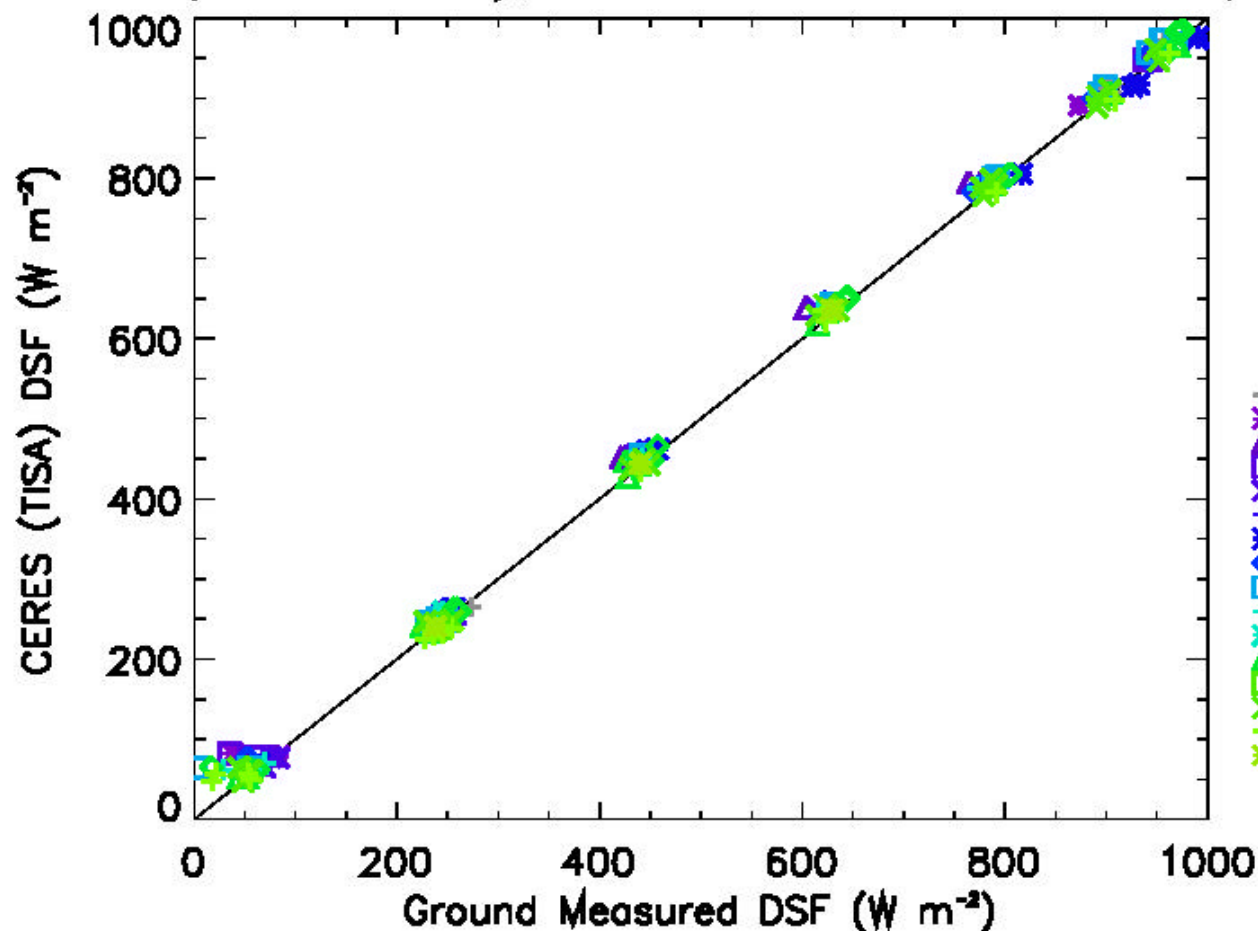


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# SRBAVG DCSW vs. ARM SGP (corrected)

Comparison of Downward Shortwave Flux(30min-Jul.)  
(Surface-only; Shortwave Model A - Clear )



Statistics:

Npoints = 174

Mean X = 489.5

Mean Y = 496.8

Mean Bias = 7.3

RMS Diff. = 13.9

Sites:

NPoints:

+	LARNED	7
*	HILLSBORO	7
△	PLEVNA	8
□	HALSTEAD	10
×	TOWANDA	30
+	ELK FALLS	30
*	COLDWATER	14
◇	ASHTON	14
□	BYRON	16
+	LAMONT	14
*	RINGWOOD	11
△	MORRIS	15
□	MEEKER	1
×	CORDELL	27
+	CYRIL	19
*	SEMINOLE	3



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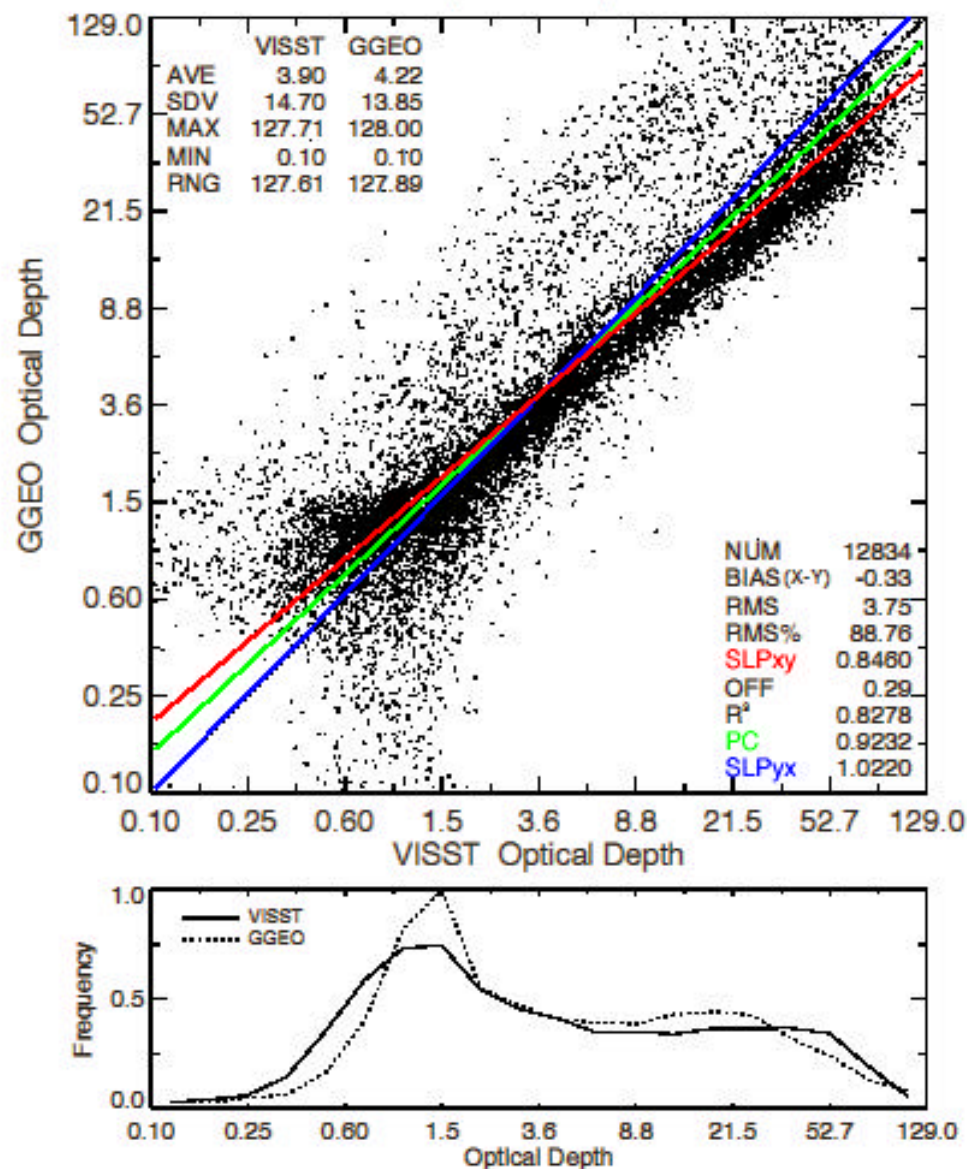
# CONUS Cloud Property Validation Data Set

- Data description
  - Derived from GOES data using CERES cloud algorithm
  - 42 - 32 N; 105 - 91 W (Includes ARM SGP)
  - Half-hourly resolution
- Half-hour resolution allows testing of interpolation
- Testing possible algorithm changes
  - Optical depth histogram equalization
  - Normalize night / day retrievals
  - Use daytime cloud emissivity at night





## Optical Depth



# GEO vs VISST

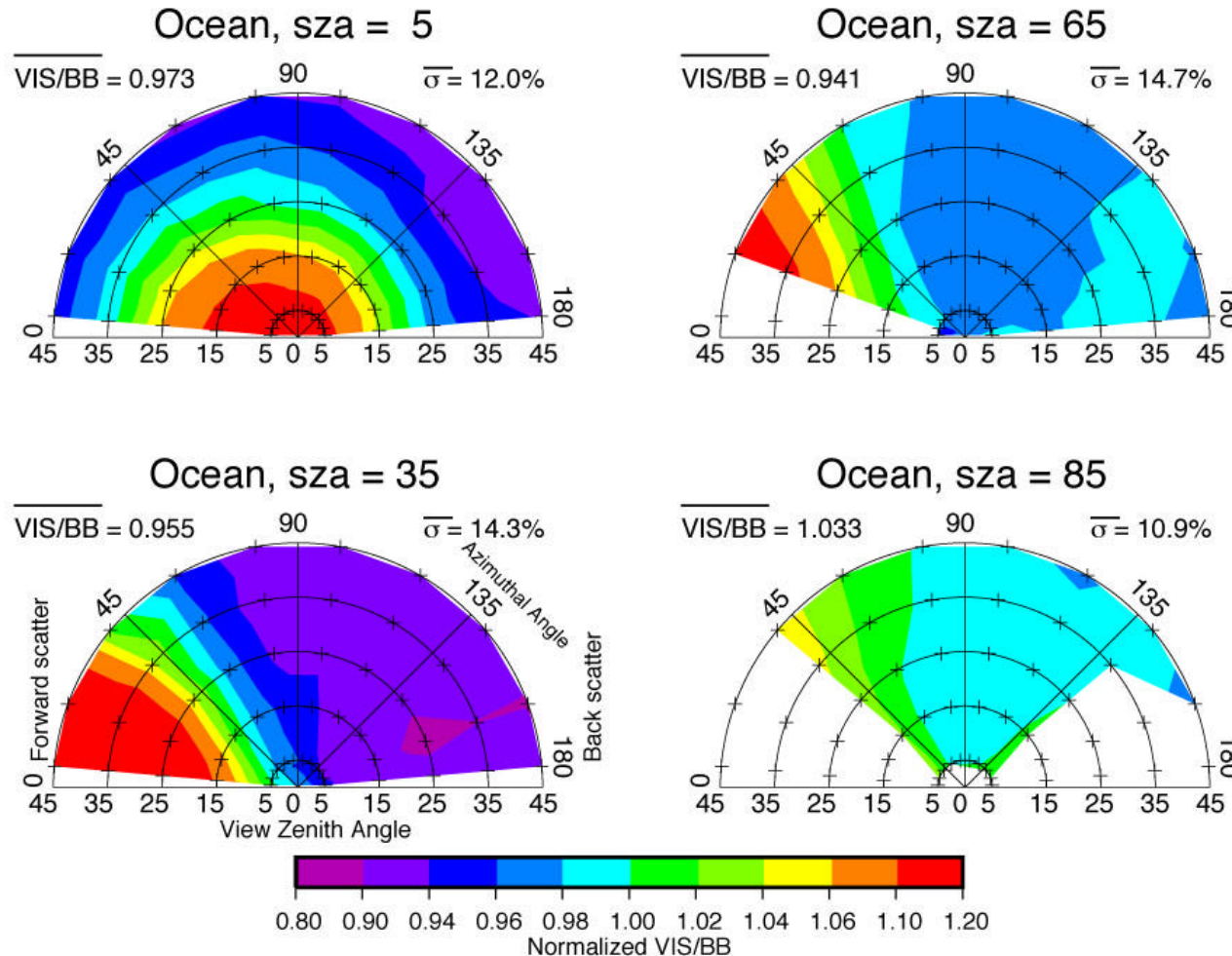
## Optical Depth

# Future

- Goal: 3 years of validated SRBAVG by March STM
- Validation
  - SW integration test for snow
  - GEO calibration sensitivity for Terra
  - Terra surface flux comparison (BSRN and SRB)
  - Cloud interpolation over CONUS
  - March 2000 TRMM/Terra comparison
- GEO
  - Move to Mcldas data
  - Plan for 1-hourly GEO for reprocessing
  - Extend calibration studies
  - Narrowband - Broadband improvement (Doelling)



# Normalized VIS/BB Ratios for clear-sky ocean (various SZA)



Ratios are scene type and angle-specific

Details to follow from Doelling



# Extras



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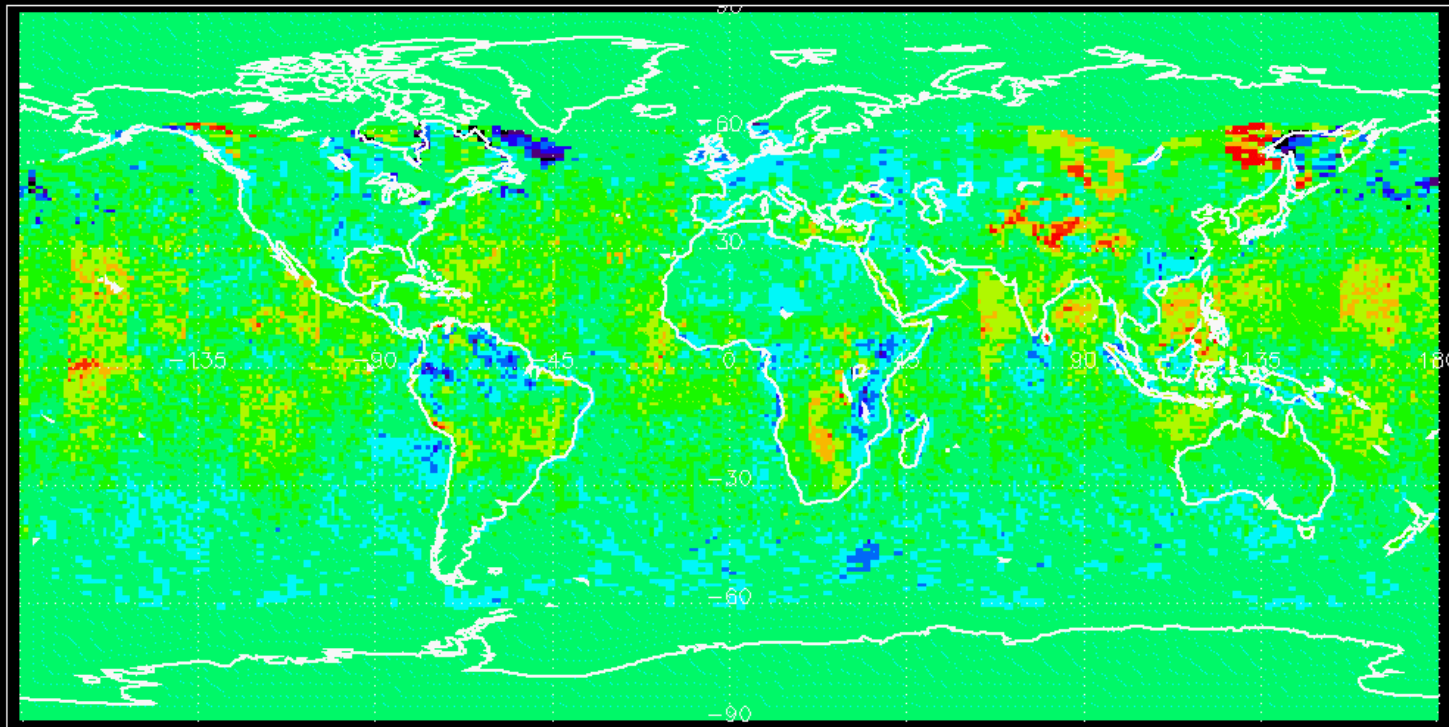
# Annual (2001) Mean TOA Fluxes

	ERBELike	nonGEO	GEO
LW	238.7	238.2	237.5
SW	98.0	98.1	98.6
Net	4.6	6.5	5.0
Albedo	28.7%	28.7%	28.9%
Clear LW	266.6	265.9	263.9
Clear SW	48.6	51.8	51.8
Clear Net	29.5	34.2	35.8
Clr Albedo	14.25%	15.2%	15.2%



# GEO - nonGEO TOA SW Flux Difference Monthly Mean April 2001

larc.nasa.gov/DaveY/Terra\_FM1\_200101\_wt\_new\_GGEO/CER\_SRBAVG1\_Terra-FM1-MODIS\_Beta1\_011019.200104 Wed Nov



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(1) Data & (2) Std Dev: Watts per square meter, (3) Num. Obs.: Unitless



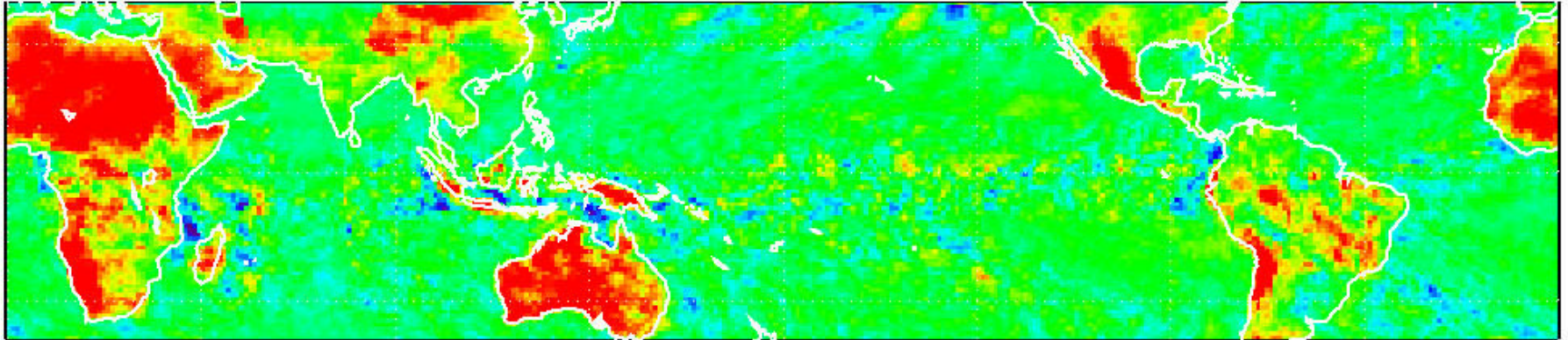
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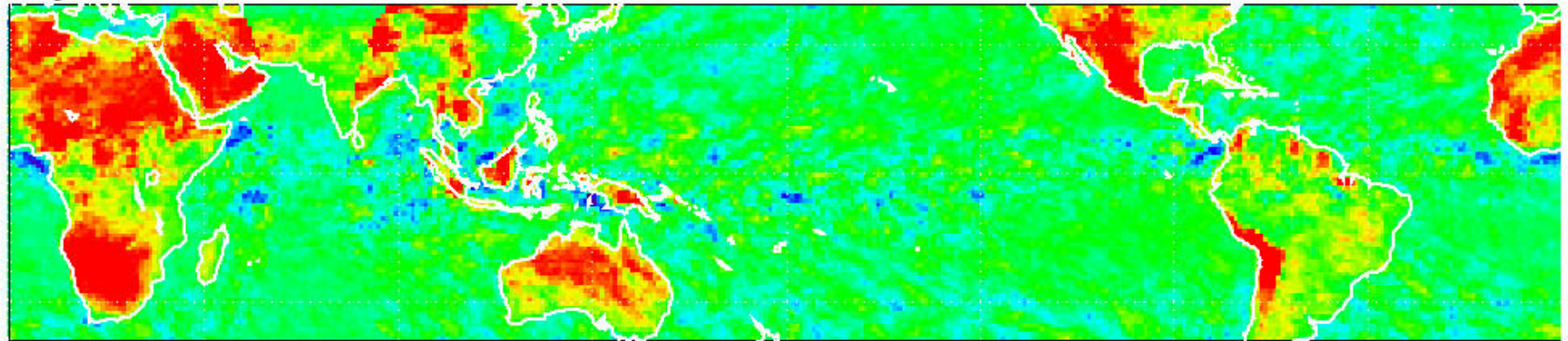


# TRMM Monthly Mean GEO-nonGEO Total-sky LW Flux Diurnal Range

February



May

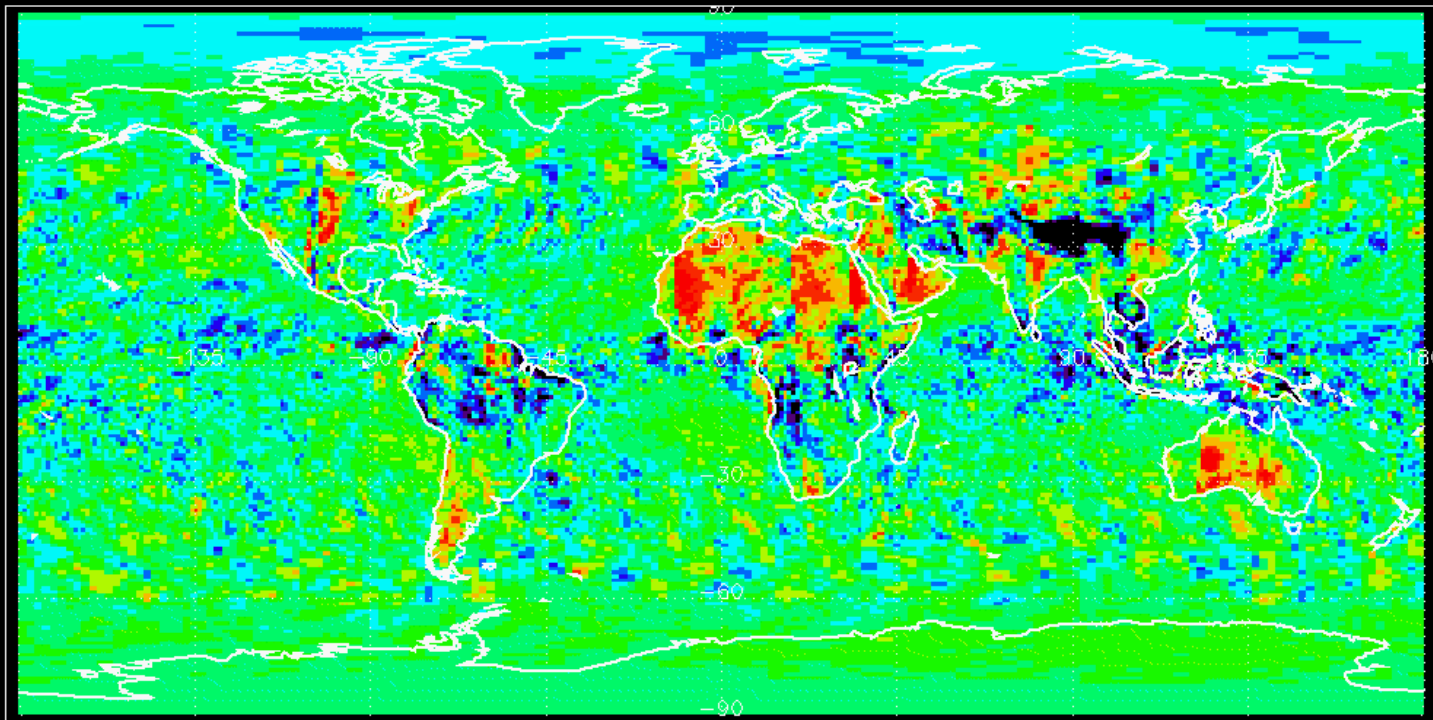


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# TOA LW Flux 2:30 - 9:30 GEO April 2001

larc.nasa.gov/DaveY/Terra\_FM1\_200101\_wt\_new\_GGEO/CER\_SRBAVG1\_Terra-FM1-MODIS\_Beta1\_011019.200104 Wed Nov



No. -20 -15 -11 -6 -2 2 6 11 15 20 -->  
(1) Mean & (2) Std Dev: Watts per square meter, (3) Num. Obs.: Unitless



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